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## **ROUGHAGE LEVELS AND COMPARISON OF MIXED RATIONS VS SELF-FEEDERS IN WHOLE SHELLED CORN FINISHING PROGRAMS**

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### **Summary**

Two trials were conducted to evaluate roughage levels in whole shelled-corn finishing diets and to compare use of self-feeders to a total mixed ration in a whole corn program. In trial 1, steers were fed whole corn diets alone or with 4 or 8% roughage or a rolled corn diet with 8% roughage. Increasing the roughage level increased dry matter in take, feed required per unit of gain, and carcass weight and finish, and reduced the incidence of liver abscesses. Despite better feed efficiency and lower costs of gain, reducing the dietary roughage level reduced profitability because of lighter slaughter weights. In trial 2, feeding 4% vs no roughage in a whole-corn finishing program increased dry matter intake and tended to increase rate of gain by finishing heifers. No performance benefit resulted from feeding a total mixed ration vs using self-feeders and providing chopped hay in a feed bunk.

Feeding very little or no roughage in whole corn diets can improve feed efficiency and reduce cost of gain. However, these advantages can be outweighed by potentially lower slaughter weights and increased metabolic problems (acidosis, bloat, liver abscesses).

(Key Words: Whole Shelled Corn, Roughage Level, Feedlot.)

### **Introduction**

Whole shelled corn has been successfully used in cattle finishing programs for years. Whole corn diets are assumed to need lower

amounts of roughage, because whole corn is thought to have some roughage value itself. However, little information exists for optimal roughage levels in whole corn rations. Further, although unproven, it is assumed that feeding a total mixed ration is preferable to using self-feeders in whole corn programs because roughage is supplied at the same time as the concentrate. Therefore, two studies were conducted to 1) identify the optimal roughage level for whole-corn finishing diets, and 2) to compare use of a whole corn ration (with or without roughage) in self-feeders to a total mixed ration.

### **Experimental Procedures**

*Trial 1.* Ninety-two Angus crossbred steers (633 lbs) were allotted to one of three weight blocks and then assigned to one of four pens within each block. Treatments were whole shelled corn (WSC) diets without roughage or with 4 or 8% roughage (dry basis). A fourth treatment, dry rolled corn plus 8% roughage, served as a positive control.

In addition to the appropriate roughage level, all diets contained (dry basis) 3% molasses and 6.5% of a pelleted protein supplement. Diets were formulated to contain 12.25% crude protein, .70% Ca, .35% P, .7% K, and 100 ppm Zn. Diets contained monensin (27 g/ton) but no tylosin. Steers had been vaccinated, dewormed, and implanted with Revalor-S®. The trial was conducted from January 2 to June 15, 1993 (166 days). Slaughter and carcass data were obtained at the conclusion of the study.

*Trial 2.* Sixty-three heifer mates (715 lbs) to the steers in Trial 1 were used to evaluate the effects of offering roughage to cattle finished on whole corn and pelleted protein supplement in self-feeders and to compare these systems to a total mixed ration. Treatments were: 1) a total mixed ration with 4% alfalfa hay (dry basis), 2) a whole corn plus pelleted protein supplement offered ad libitum from self-feeders, and 3) treatment 2 plus 4% hay offered in a feed bunk.

Diets and supplements were similar to those in Trial 1, except molasses was reduced to .75% of the dry ration to facilitate handling in the self-feeders. Corn replaced molasses in these rations. Heifers were vaccinated, dewormed, and implanted with Finaplix-H and Ralgro. The study was conducted from April 20 to July 19, 1993 (90 days). Daily hay fed in treatment 3 was based on the previous day's hay consumption by heifers in treatment 1 and was offered in the morning. Three pen replicates were used per treatment.

## Results and Discussion

*Trial 1.* Although adding roughage up to 8% of the diet dry matter linearly increased ( $P<.05$ ) total intake by steers fed whole shelled corn (Table 1), corn intake remained constant. Steers fed dry rolled corn diets (8% roughage) consumed 10.5% more ( $P=.13$ ) dry matter and corn than steers fed WSC with 8% roughage. The latter observation is consistent with other research and suggests that chewing efficiency (particle size reduction) may limit intake of whole vs processed corn.

Daily gain tended ( $P=.2$ ) to increase with increased roughage level. Increased roughage levels resulted in a linear increase ( $P<.10$ ) in feed required per unit of gain, as well as a linear reduction ( $P<.10$ ) in net energy concentration of the diet. The

latter, calculated from performance, was expected because adding roughage dilutes the net energy concentrations of high-grain diets.

The tendency for increased weight gain with increased roughage level translated into heavier, more highly finished carcasses (Table 2). Hot carcass weight and degree of marbling ( $P<.10$ ) and backfat thickness ( $P<.05$ ) increased as roughage level increased. The incidence of liver abscesses was greatest ( $P=.11$ ) without roughage and tended to decline as roughage level was increased. The severity of liver abscesses was also greatest without roughage and tended to decline linearly ( $P<.2$ ) with added roughage.

Adding roughage to whole shelled corn diets not only reduced feed efficiency, but increased both cost of gain and calculated selling breakeven price for the steers (Table 2). However, because of more weight sold (live or carcass) from the 8% roughage treatments, net returns were not different. Therefore, it is important to remember that reducing cost of gain does not always translate into increased profitability.

*Trial 2.* Similar to trial 1, heifers fed roughage, whether in a complete mixed ration or separately in the feed bunk, consumed more feed ( $P=.06$ ) and gained 10.6% faster ( $P=.19$ ) than heifers fed from self-feeders alone (Table 2). The differences would likely have been greater had 8% roughage been used.

Although reported efficiencies are similar, they do not include a heifer that died of bloat on the self-fed (no hay) treatment. Accounting for that heifer changes daily gain to 2.58 lb/day and feed/gain to 6.80. We observed no apparent advantage to feeding a total mixed ration vs using self-feeders and offering an equivalent amount of roughage in the feed bunk.

**Table 1. Performance, Net Energy Values, Carcass Traits, and Economics (Trial 1)**

Ingredient	Treatment <sup>a</sup>			
	WSC-0	WSC-4	WSC-8	DRC-8
In wt., lb	632	633	632	634
Payweight out, lb <sup>b</sup>	1149	1152	1171	1190
Daily gain, lb	3.12	3.13	3.24	3.35
Daily feed, lb DM <sup>c</sup>	18.6	19.6	20.5	21.6
Feed/gain <sup>d</sup>	6.06	6.33	6.37	6.54
Corn/gain	5.41	5.41	5.21	5.32
NEm, Mcal/cwt				
Diet <sup>d</sup>	98.3	94.7	93.5	91.8
Corn	102.7	100.1	100.7	98.7
NEg, Mcal/cwt				
Diet <sup>d</sup>	67.6	64.4	63.3	61.9
Corn	70.4	68.5	69.0	67.3
Hot carcass wt, lb <sup>d</sup>	704	703	731	753
Dressing pct.	61.3	60.9	62.6	63.3
Backfat, in <sup>c</sup>	.36	.39	.50	.51
KPH fat, % <sup>c</sup>	2.37	2.34	2.52	2.55
Marbling <sup>d,f</sup>	Mt <sup>12</sup>	Mt <sup>28</sup>	Mt <sup>71</sup>	Mt <sup>60</sup>
Choice, %	100	100	100	100
Liver data				
Abscessed, % <sup>g</sup>	35	13	9	7
Severity score <sup>h</sup>	.48	.17	.17	.44
Cost of gain, \$/lb <sup>i</sup>	.449	.464	.460	.469
BE at 1150, \$/cwt <sup>j</sup>	72.47	73.10	73.35	73.77
Profit (loss), \$/head <sup>k</sup>				
Sold live	28.27	21.83	28.96	30.39
In the meat	4.28	(5.60)	20.60	33.96

<sup>a</sup>WSC=whole shelled corn; DRC=dry rolled corn; 0, 4, or 8 is percentage alfalfa hay in the diet (dry basis). <sup>b</sup>Final live weight pencil shrunk 4%. <sup>c</sup>Linear (P<.03). <sup>d</sup>Linear (P<.10). <sup>e</sup>Percentage kidney, pelvic, and heart fat. <sup>f</sup>Mt=modest. <sup>g</sup>Treatment effect (P=.11) using Chi-square. <sup>h</sup>0=no abscess, 3=severely abscessed. <sup>i</sup>Based on \$2.40/bu corn. Ration costs marked up 20%, and \$.35/head/day charged for yardage and interest. <sup>j</sup>Breakeven price for 633 lb feeders at \$95/cwt. <sup>k</sup>Based on live weight price of \$75/cwt and carcass price of \$119/cwt.

**Table 2. Performance of Heifers Fed Whole Shelled Corn in a Total Mixed Ration or Self-Feeders (Trial 2)**

Item	Treatment <sup>a</sup>			SEM
	TMR	Self	Self + Hay	
Beginning wt, lb	711	722	712	
End wt, lb	1006	1003	1012	
Daily gain, lb <sup>b</sup>	3.29	3.12	3.33	.097
Daily feed, lb dry matter <sup>c</sup>	18.8	17.5	18.6	.38
Feed/gain	5.71	5.59	5.59	.121

<sup>a</sup>TMR=total mixed ration; Self=self-fed whole corn plus pelleted supplement self-fed; Self + hay=self-fed plus 4% hay provided in feed bunk. <sup>b</sup>Roughage vs none (P=.19). <sup>c</sup>Roughage vs none (P=.06).